



SAGE III Measurement System Validation

Science Team

- *Mike Pitts, LaRC – PI, LAABS Instrument Lead*
- *Joe Zawodny, LaRC – Co-I, GAMS Instrument Lead*
- *Larry Thomason, LaRC – Co-I*
- *Sam Yee, JHU/APL – Co-I*

Data Acquisition Team

Earnest Burcher, Glenn Farnsworth, Ruben Remus, Brian Wenny

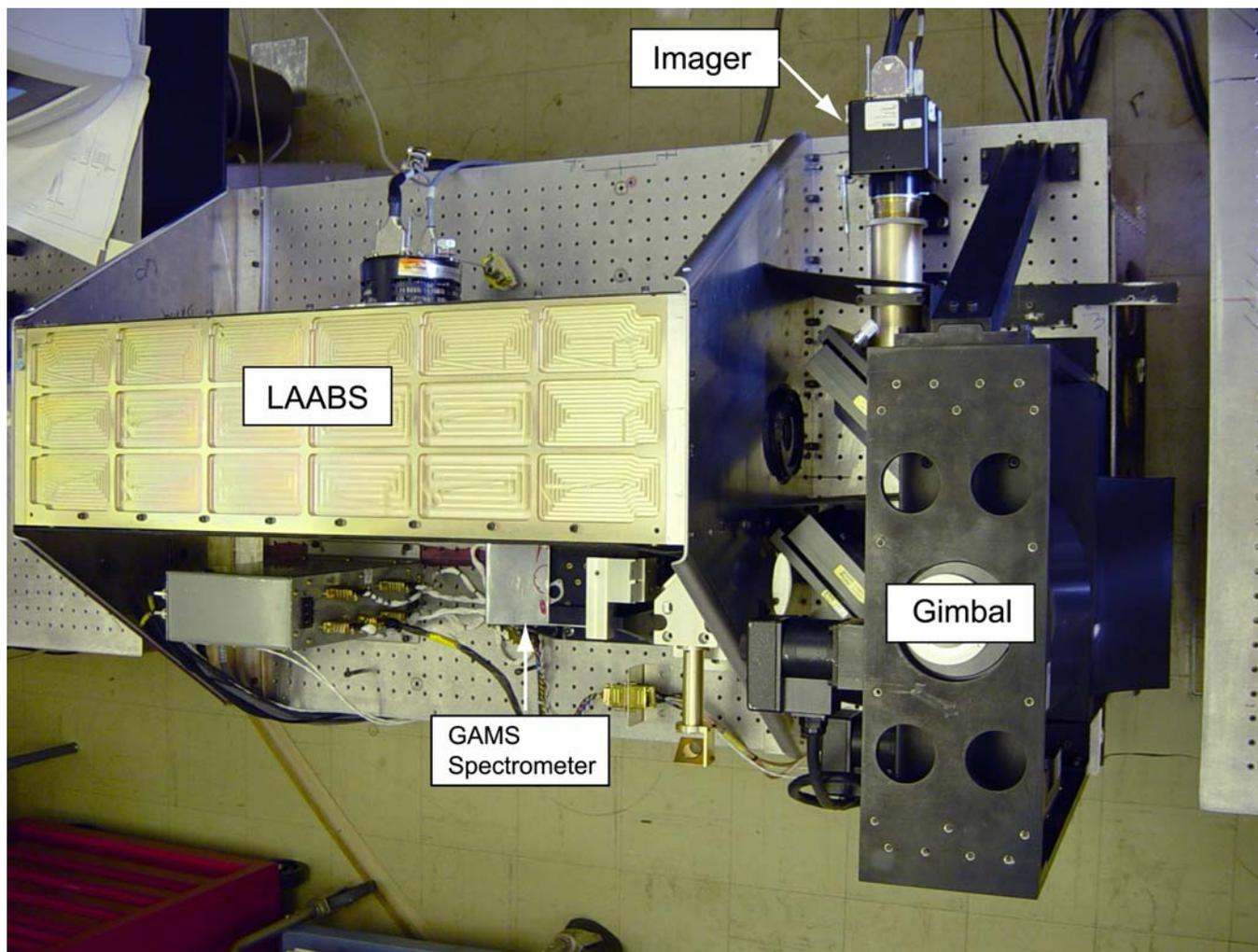


Instrument Suite

- **Gas and Aerosol Measurement Sensor (GAMS)**
 - Solar spectrometer with 1024 channels from ~ 430 to 1030 nm
 - Provides measurements of LOS transmission spectra and differential O_3 , H_2O , O_2 , O_4 , and aerosol
 - Solar imager to monitor scene homogeneity
- **Langley Airborne A-Band Spectrometer (LAABS)**
 - High spectral resolution (~ 0.035 nm) grating spectrometer with > 800 channels from ~ 759 to 771 nm
 - Provides measurements of LOS transmission spectra for evaluation of SAGE III O_2 A-band forward model
- Instruments co-aligned using common pointing system to track Sun through aircraft view port



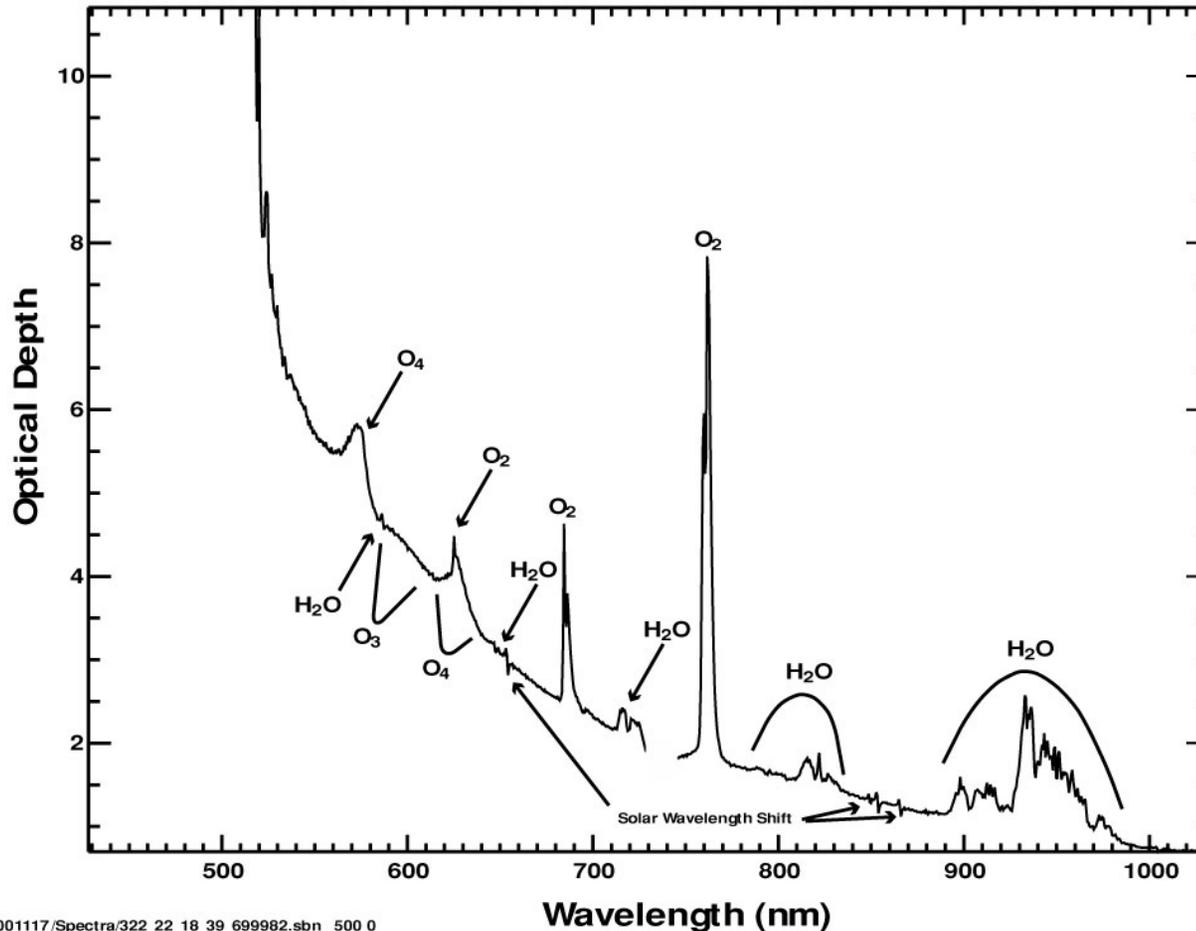
GAMS/LAABS Layout





GAMS Spectral Coverage and Observable Species

GAMS Test-Flight Spectra: 17 November 2000

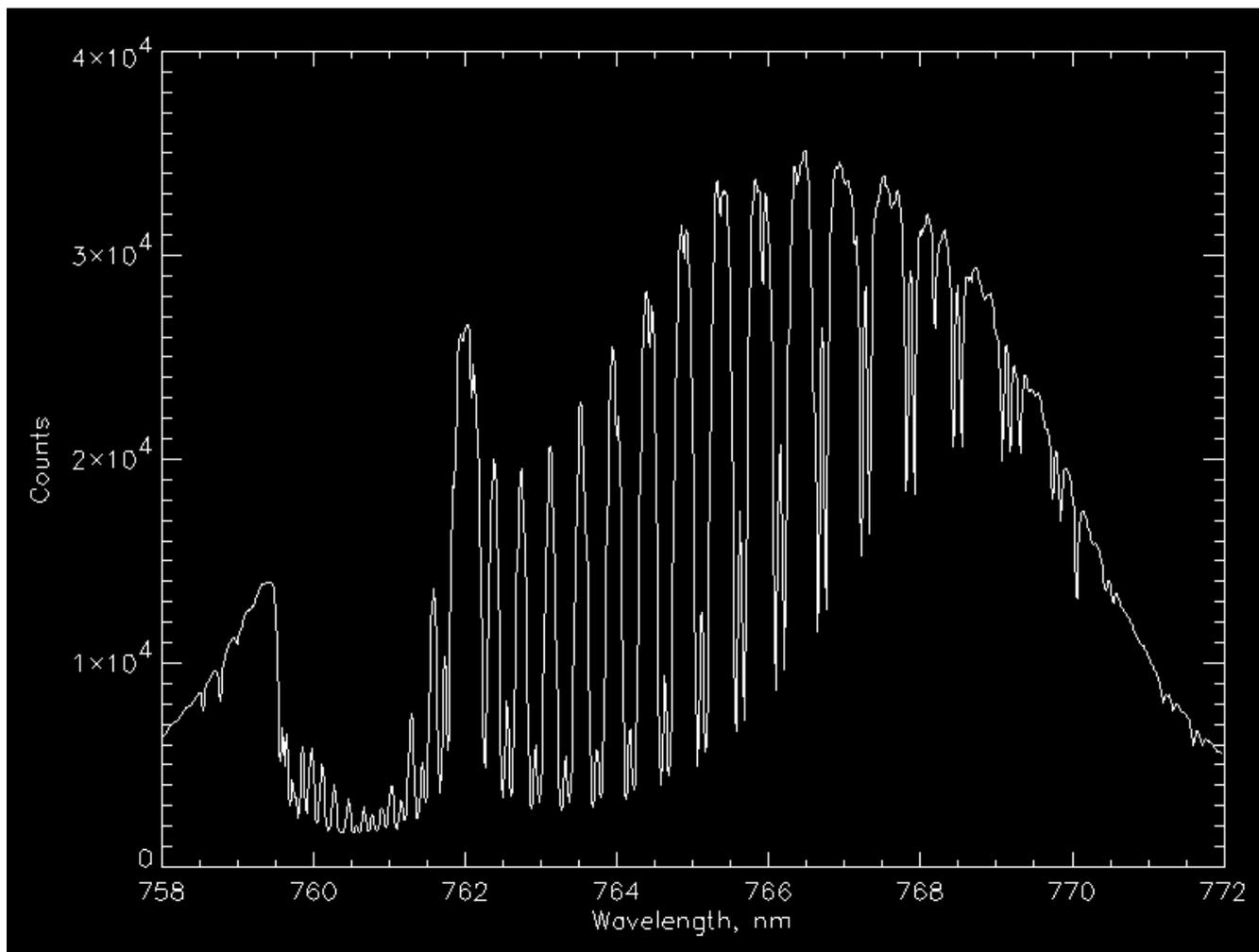


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LAABS Sample Spectrum

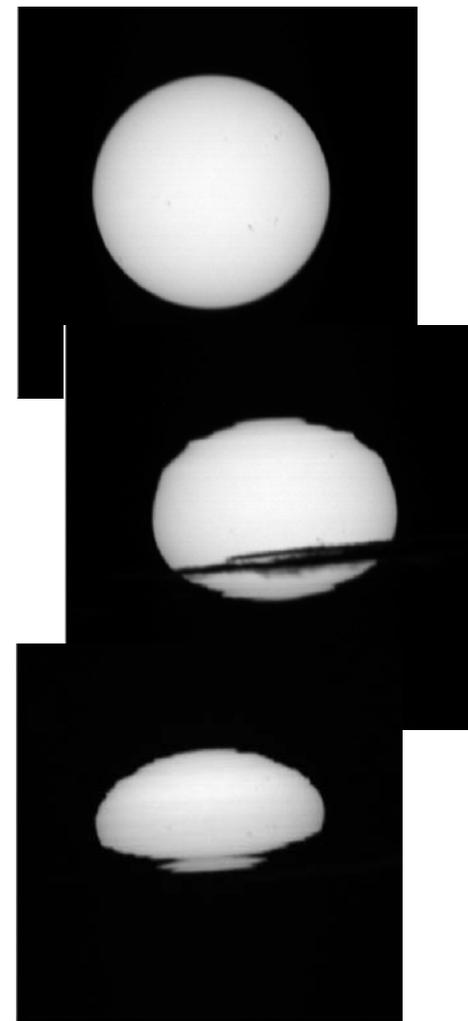
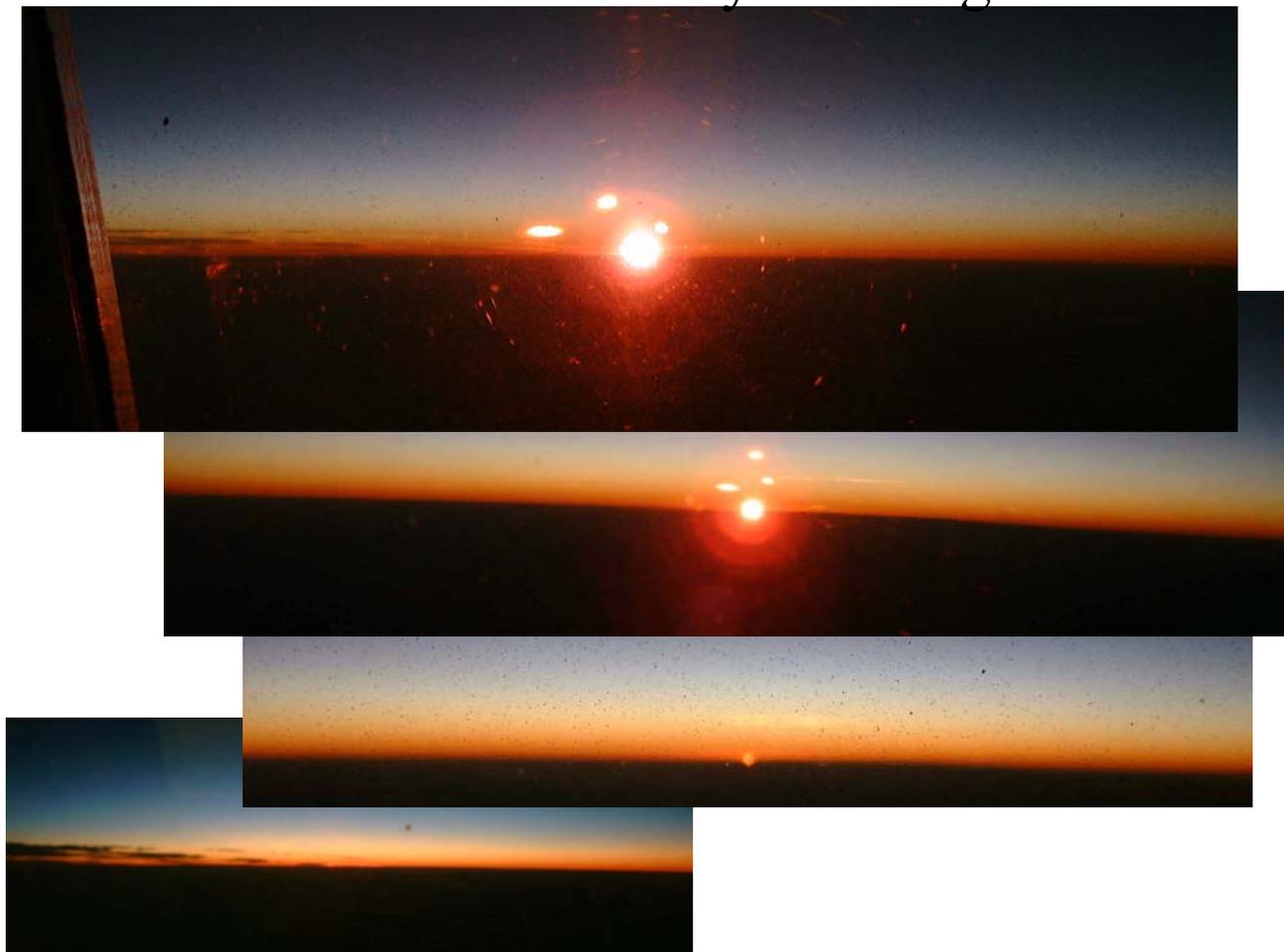
Sunrise data from Dec. 8, 2002





GAMS Imager Monitors Inhomogeneity

- Sunset: Naked Eye & Imager



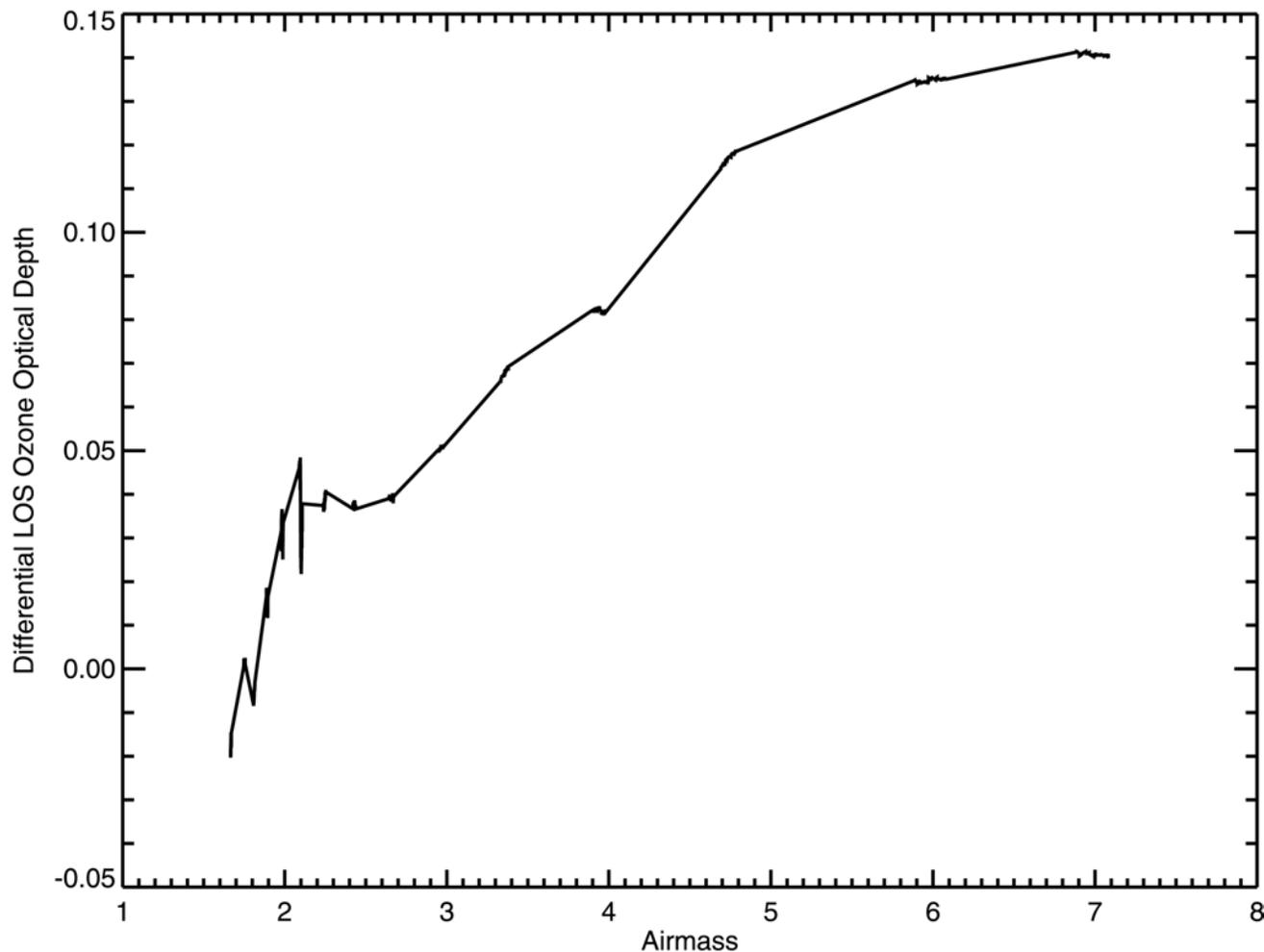


GAMS/LAABS Quick-Look Products & Other Activities

- Differential LOS Ozone, NO₂, O₄, water vapor
 - Using SAGE III-like MLR algorithm
 - Using GAMS full spectrum algorithm
- LOS (aerosol) OD values using test flight I₀ values
- Comparisons using profile data (1-D/2-D) transformed to GAMS/LAABS LOS geometry (SAGE III quick-look data, AROTAL, AATS-14, SCIAMACHY, POAM, etc.)

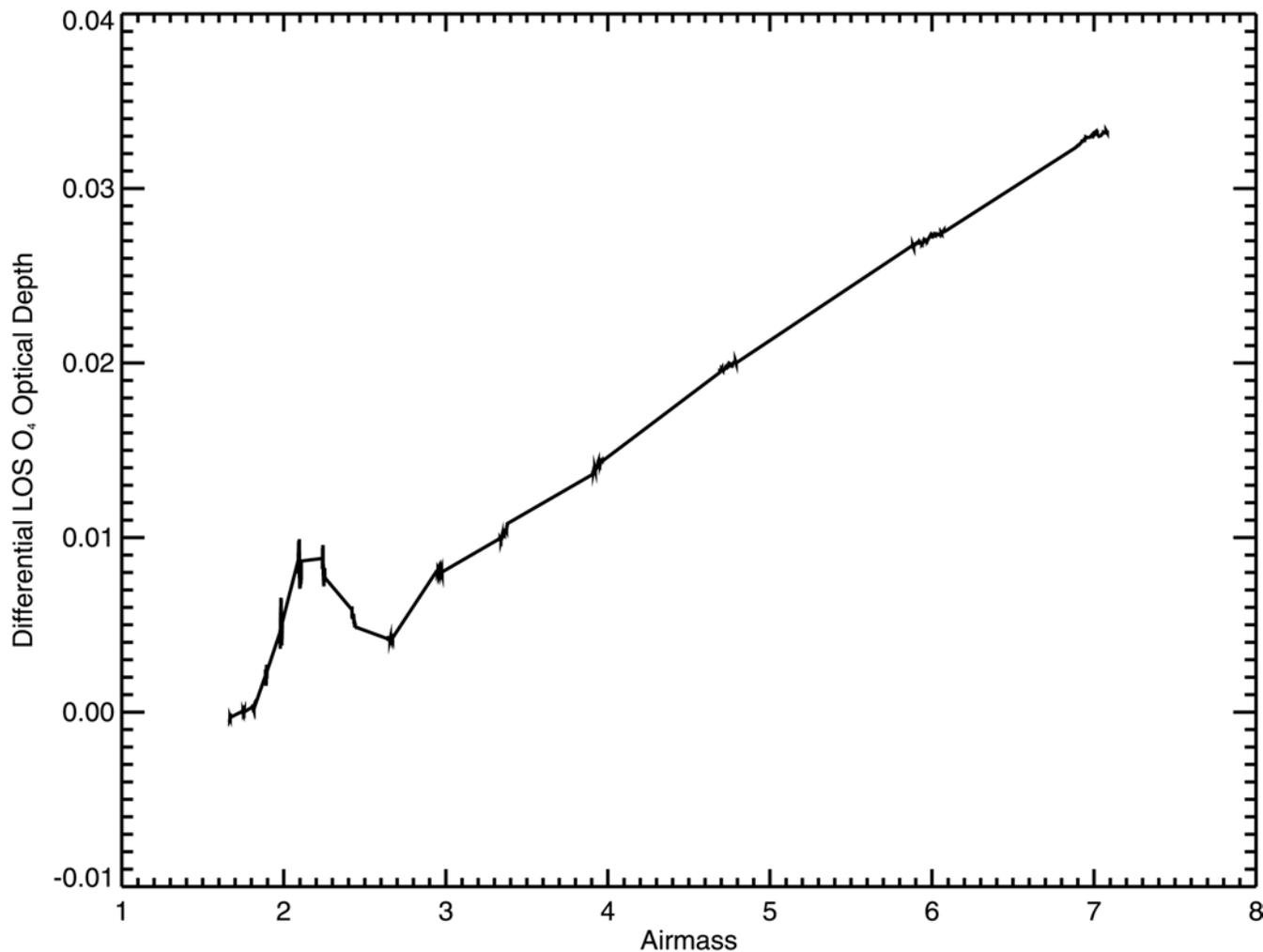


GAMS Differential LOS Ozone Optical Depth





GAMS Differential LOS O₄ Optical Depth





Post-Deployment Activities

- SAGE III etaloning/mirror correction validation
- O₂ spectroscopy and forward model verification
- Ozone spectroscopy near O₂ A-band and 940-nm water vapor features
- Relative strength of spectroscopic features (e.g., water vapor features at 600 nm and 940 nm)
- SAGE III algorithm evaluation
- Altitude registration validation using oxygen measurements (lunar)
- Archival products include DLOS/LOS species, spectra



Measurement Objectives

- ✓ Coincidence with SAGE III in homogeneous air mass (cloud-free above tropopause)
- ✓ Sun run in very cold air with no PSCs
 - Does not require SAGE III coincidence
 - Minimum for success: $T < 210$ K
 - Full success: $T < 200$ K
- ✓ Coincidence with SAGE III in spectral survey mode
 - Cross-vortex event – does not require SAGE III coincidence
 - Flights at tropospheric levels to look at H₂O – does not require SAGE III coincidence
 - Near coincidence with SAGE III lunar event



SOLVE II Flight Requirements

- Minimum 10-minute flight segments
 - 5 minutes to lock on sun
 - 5 minutes solar data acquisition
- Flight track normal to sun
- Flight altitude of 11-12 km preferable
- SAGE III coincident data acquisition periods intersect tangent altitude ground track

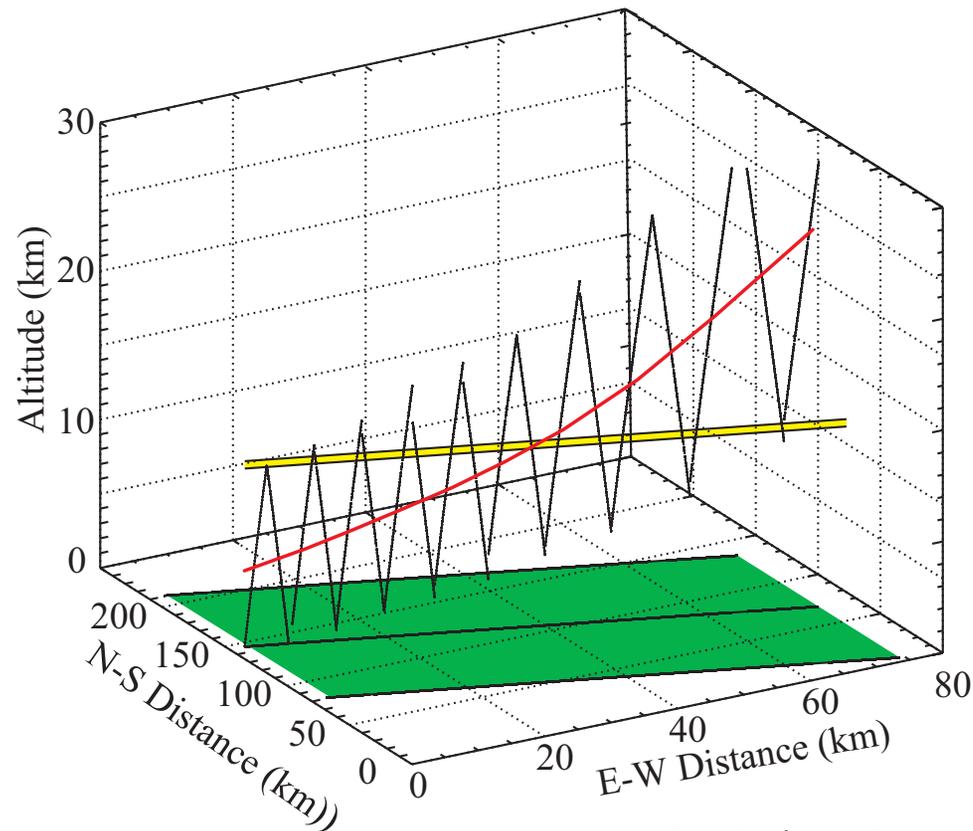


GAMS/LAABS Science Contribution

- Strongly contributes to understanding of SAGE III algorithm issues
 - Clearing effects of etalon
 - Altitude registration using O₂ A/B bands
 - Ozone spectroscopy near O₂ A band and water vapor features
- Direct measurement of air mass with LAABS spectrometer
- DC-8 – based SAGE-like measurement



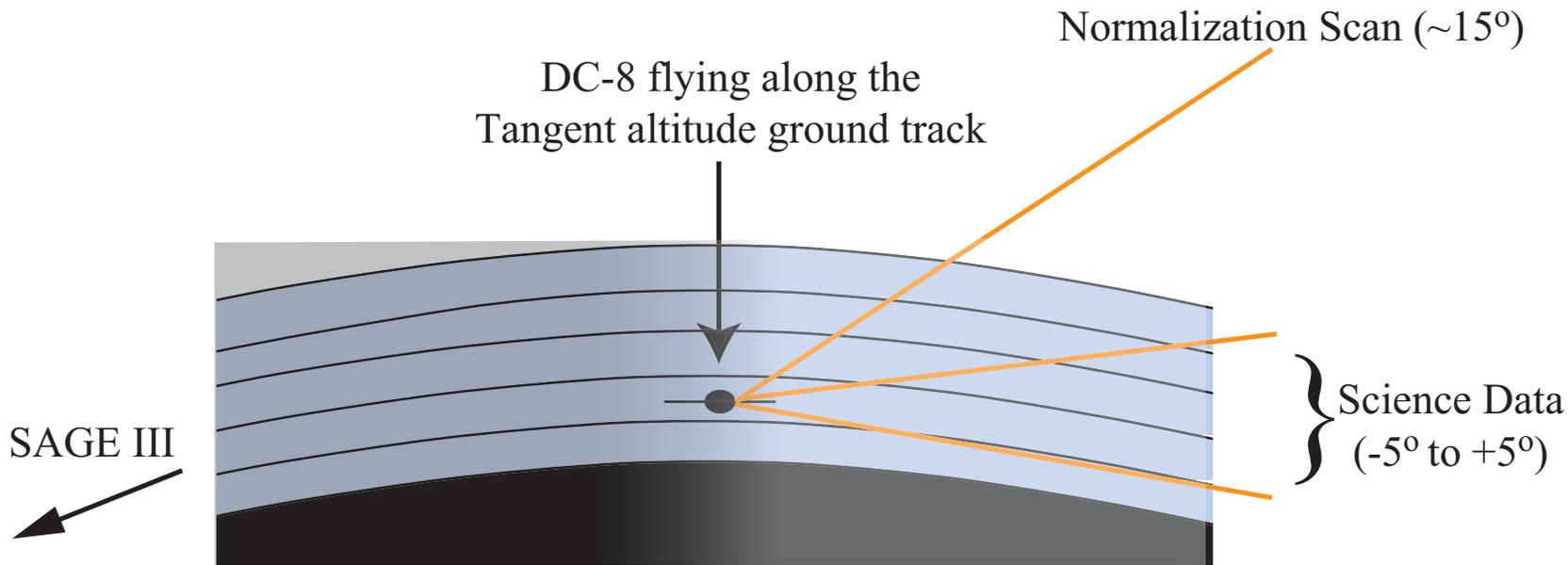
SAGE III Measurement Volume



Beta Angle = 40
Green Area = Line-of-sight path in
lowest 0.5 km altitude

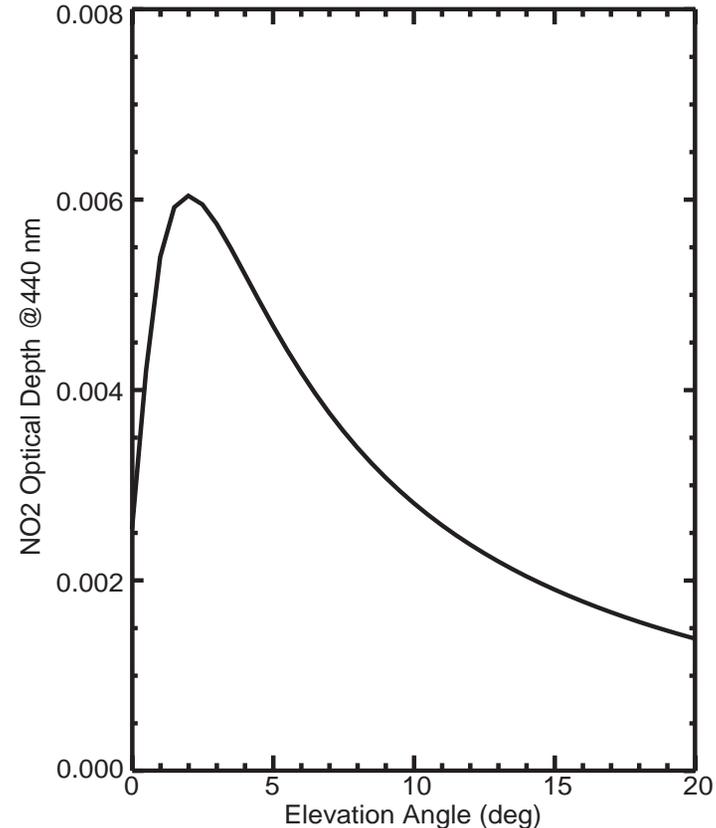
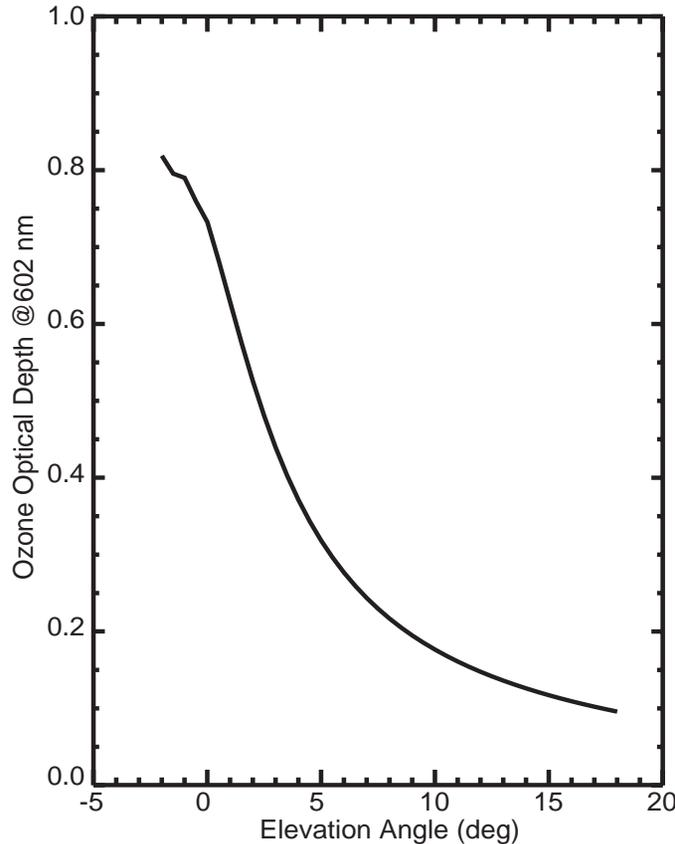


Flight Geometries





DC-8 Geometry LOS Optical Depth



Flight Altitude: 11.9 km; SAGE III event 286110 (7/7/2002; 56 S; 90 W)



DC-8 Geometry LOS Optical Depth (2)

